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SCIENCE RESOURCES STUDIES HIGHLIGHTS

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Defense Leads R&D Growth in FY 1983—Energy and Natural Resources and Environment Fall Sharply

The following data are taken from a special NSF report, Federal R&D Funding by Budget Function: Fiscal Years 1981-83, *relating to the current budget period. Data show funding levels as proposed in the President's 1983 budget in February 1982. Of the 15 budget functions with R&D components, one,* **general science, space and technology**, *is divided for purposes of the report into two functions:* **Space research and technology**, *and* **general science**. *Data are based on information provided by the agencies for "Special Analysis K: Research and Development" in the 1983 budget and on further detailed program information in agency budget justification documents. All dollar data are shown in terms of budget authority, which forms the basis of congressional funding decisions. Budget authority dollars are the amounts Congress authorizes the Government agencies to obligate or actually disburse as outlays. R&D plant data are excluded.*

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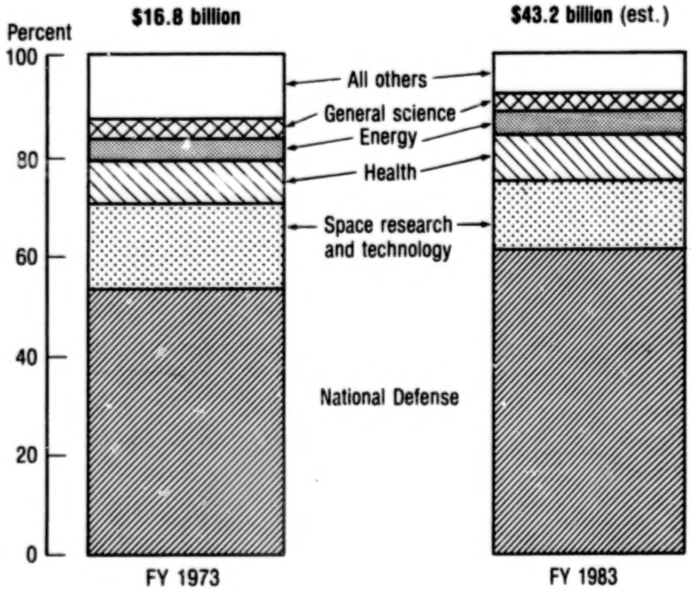
Highlights

- Budget authority for Federal R&D programs (R&D plant excluded) in the President's 1983 budget was an estimated $43.2 billion—nearly 12 percent more than the $38.7 billion for 1982, allowing for growth ahead of inflation.[1] The comparable growth proposed for the overall Federal budget was 5 percent.
- National defense showed the largest R&D funding growth in 1983, advancing by 20 percent. This increase, following a gain of 20 percent in 1982, places defense in a more dominant position than at any time in the past decade. National defense is now estimated at 61 percent of the Federal R&D total in 1983 compared with 54 percent in 1973 (chart 1).
- Space research and technology programs were proposed for a 12-percent increase in 1983 with priority given to space shuttle flight operations and space science programs. Space and defense programs make up three-fourths of the 1983 Federal R&D total.
- A net reduction of 5 percent was proposed for nondefense/nonspace R&D programs in the 1983 budget following an 8-percent reduction in 1982. Seven of the 14 functions in this group showed reductions in 1983.
- Energy R&D funding showed the greatest decline, dropping 30 percent below the 1982 level (chart 2). This decrease, following a 17-percent decrease in 1982, reflected an administration policy of encouraging private sector funding of energy technology programs.
- Health R&D programs were scheduled for a 4-percent increase in 1983 compared with virtually no change in 1982.

Chart 1. Share of leading functions in the Federal R&D total[a]



[a]Based on obligations for 1973 and budget authority for 1983.
SOURCE: National Science Foundation.

- Basic research support was provided in all functional areas in the 1983 budget, for a total of $5.9 billion in budget authority. This represented a 9-percent increase over 1982, allowing for some real overall growth. Seven out of eight leading support areas showed gains, with the greatest relative increases scheduled for defense, space, and energy programs.

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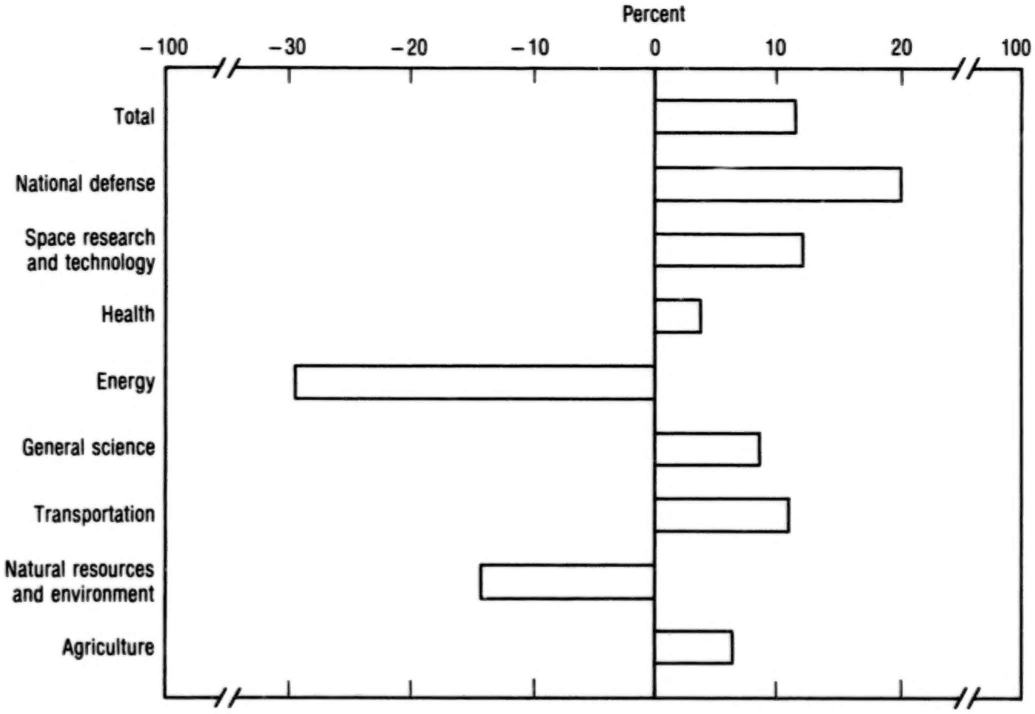
[1] The rate of inflation anticipated by the Office of Management and Budget for fiscal year 1983 is 6.0 percent, compared with 7.3 percent for 1982 (based on the GNP implicit price deflator).

Prepared in the Government Studies Group, Division of Science Resources Studies.

Chart 2. FY 1982-83 percent change in R&D budget authority, by leading functions in the 1983 Federal budget



SOURCE: National Science Foundation

The 1983 Budget

The President's budget for fiscal year 1983, presented in February 1982, expressed a continued commitment to the fundamentals of the economic recovery program outlined in the 1982 budget. The focus in 1983 remained on reducing the rate of growth of overall Federal spending and decreasing the Federal regulatory burden.

Support for R&D programs in the 1983 budget reflected a clearer delineation between the responsibilities of the Federal Government and the private sector than had previously been the case. Budget authority requested for R&D programs in 1983 was nearly 12 percent higher than the 1982 level, growing from $38.7 billion to $43.2 billion. These funds were intended to support basic research across a spectrum of activities, but limited spending on technology development to areas of national interest, such as defense, or to technologies requiring a long period of initial development, such as fusion power, where the risk is high but the payoff to the Nation is potentially great.

The increase of approximately $4.5 billion in 1983 was largely for national defense R&D programs. Smaller but significant increases were proposed for space, transportation, and general science R&D programs. Large relative decreases were proposed for R&D programs in energy and natural resources and environment, following lesser relative decreases in 1982.

R&D Programs by Function

- **National defense** R&D programs—sponsored by the Department of Defense (DOD) and the proposed Energy Research and Technology Administration (ERTA) within the Department of Commerce—would grow $4.4 billion over the 1982 level to $26.4 billion in 1983 (table 1). This amounted to an increase of approximately 20 percent. Within DOD, *strategic* and *tactical* programs made up the largest mission areas, together accounting for almost three-fifths of the R&D total. *Strategic* programs showed the greatest relative increase of any area, 43 percent above the 1982 level. This represented an increase of $2,004 million, of which $796 million would be directed toward full-scale development of the Air Force M-X missile system. Other major strategic programs under development included a new Trident II missile, an upgraded version of the B-1 bomber, ballistic missile defense systems technology, and an improved command control and communications capability. Development of long-term ICBM basing and space defense was also included in strategic activities. *Tactical* programs were expected to increase almost 10 percent, or $676 million. This area included increases for development of lightweight, highly mobile armored vehicles and weapons, and helicopters. It also included advancements in funding for target acquisition and command and control technology. In sea control, increased efforts were directed at developing the MK-48 torpedo and the DDGX destroyer. Air warfare programs included an advanced medium-range air-to-air missile (AMRAAM) and advanced technology F-15 tactical fighters.

DOD funding also included an increase of 15 percent, or $430 million, in *technology base* programs, all of them research as distinct from development. DOD *advanced technology development* programs were scheduled for growth of 30 percent, or $217 million. *Intelligence and communications* programs showed an increase of 26 percent, or $570 million. Included in this area was support for the NAVSTAR global positioning system. Within *defensewide mission support*, up 13 percent, or $312 million, DOD funding for the space shuttle was an important element.

Atomic energy defense activities, which accounted for approximately 6 percent of the national defense R&D budget total, would grow 12 percent in 1983. ERTA weapons

Table 1. Federal R&D funding by budget function[1]
[Dollars in millions]

Function	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 estimate	1983 estimate
Total	$16,800	$17,410	$19,039	$20,780	$23,983	$26,516	$29,041	$31,623	$35,547	$38,701	$43,174
National defense	9,002	9,016	9,679	10,430	11,864	12,899	13,791	14,946	18,413	22,025	26,437
Space research and technology	2,824	2,702	2,764	3,130	3,365	3,481	3,969	4,587	4,924	5,390	6,047
Health	1,585	2,069	2,170	2,351	2,629	2,968	3,401	3,694	3,871	3,864	4,013
Energy	630	759	1,363	1,649	2,562	3,134	3,461	3,603	3,501	2,889	2,034
General science	658	749	813	858	974	1,050	1,119	1,233	1,340	1,387	1,509
Transportation	572	693	635	631	708	768	798	888	869	748	831
Natural resources and environment	554	516	624	683	753	904	1,010	999	1,061	952	819
Agriculture	308	313	342	383	457	501	552	585	659	694	740
International affairs	28	24	29	42	66	57	117	127	160	164	194
Education, training, employment and social services	290	236	239	255	230	345	354	468	298	200	189
Veterans benefits and services	74	85	95	98	107	111	123	126	143	131	140
Commerce and housing credit	50	51	65	69	71	77	93	102	106	107	92
Community and regional development	78	82	93	109	101	92	127	119	104	63	45
Income security	106	71	72	48	55	67	57	77	43	35	41
Administration of justice	33	35	44	35	30	44	47	45	34	28	24
General government	7	9	12	12	13	20	23	22	22	23	22

[1] Listed in descending order of 1983 budget authority. Data for 1973-77 are shown in obligations; data for 1978-83 are shown in budget authority. Data for 1982 and 1983 are estimates as shown in the 1983 budget published in February 1982.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

research, development and testing accounted for almost two-thirds of the funding for these activities; the next largest program was naval reactors development, accounting for nearly one-fifth of the funding. These programs showed increases of 15 percent and 18 percent, respectively.

Over the 1973-83 decade, defense R&D activities have nearly tripled, growing at an average annual rate of 11.4 percent. The strongest growth took place in the second half of the decade when R&D budget authority for defense grew at an average annual rate of 15.4 percent compared with 7.5 percent in the first half.

- **Space research and technology** ranked second among major functions in terms of 1983 growth, with a 12-percent increase. All the R&D activities conducted under the space function are sponsored by the National Aeronautics and Space Administration (NASA). *Space transportation systems* (STS) accounted for more than 65 percent of the funding within space and showed an 11-percent increase. The leading STS activities are the production and operation of the space shuttle. Design, development, test, and evaluation (DDT&E) was expected to be completed in 1982, and emphasis in 1983 would be on continued production of the next three orbiters. Thus, space shuttle funding was scheduled for a 20-percent decrease, but space flight operations in connection with the shuttle would grow 91 percent.

Space science, applications, and technology is the next largest component of the space function and showed growth of 10 percent in 1983. Within this component the *space science* program was scheduled for an 18-percent increase. Growth in physics and astronomy, including the space telescope, gamma ray observatory, and work on the shuttle/spacelab payload, offset a sharp decrease in planetary exploration, even though the Galileo mission to Jupiter was retained within this broader program area. *Space and terrestrial applications* showed no growth overall; funding for Landsat-D would decline 26 percent since all the elements have been delivered and work will go forward on the fourth orbiter. Increases were shown, however, in applied research and data analysis for both resource observations and environmental observations.

- **Health** R&D budget authority increased 4 percent in the 1983 budget. Almost all the programs within this function are conducted by the Department of Health and Human Services (HHS). Approximately 88 percent of all health R&D budget authority was accounted for by the National Institutes of Health (NIH). Research project grants are the highest priority of this agency, as they have been in previous budgets. All NIH institutes would receive slight relative increases in 1983, varying from 2 percent to 5 percent. The Alcohol, Drug Abuse, and Mental Health Administration within HHS would receive a 13-percent increase over 1982. Each of the three major institutes—general mental health, drug abuse, and alcohol abuse—was expected to receive increased funding.

- **Energy** R&D programs were expected to drop sharply in the 1983 budget, declining nearly 30 percent below the 1982 level. The budget request reflected an administration policy of phasing down or terminating federally sponsored R&D programs designed to accelerate the introduction of new energy technologies. Private development of new and improved technologies is relied on more than before.

ERTA is the primary source of R&D support within the energy function. Other agencies providing R&D funds are the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA). Only two ERTA programs, magnetic fusion and supporting research, were expected to grow in 1983. R&D budget authority for magnetic fusion showed an increase of 23 percent, much of which was devoted to confinement systems. A 12-percent increase for supporting research occurred primarily in basic energy sciences.

The largest decrease was for the ERTA fossil energy program, which fell 74 percent from the 1982 amount. Fossil energy R&D efforts are being redirected to long-term generic research and away from acceleration of development of short-run technologies and from demonstration activities that were intended to encourage early commercialization by the private sector. R&D budget authority for nuclear fission declined 23 percent and included relatively large cutbacks in converter reactor systems and commercial nuclear waste activities. Within the nuclear fission program, however, growth of 30 percent was scheduled for the Clinch River breeder reactor demonstration project. Solar energy development dropped 71 percent in the 1983 budget, reflecting the administration's reliance on marketplace supply and demand.

Energy R&D programs of NRC fell 1 percent in 1983, while those of EPA were scheduled to decrease by 34 percent as research programs were completed. Funding for EPA energy programs in 1983 was 66 percent below the 1981 figure.

Changes in R&D funding for energy over the 1973-83 decade are more dramatic than those for any other function. From 1973 to the peak year of 1980, support grew at an average annual rate of 28.3 percent, but was expected to fall at an average annual rate of 17.4 percent from 1980 to 1983.

- **General science** consists of all National Science Foundation (NSF) research programs and three ERTA programs. R&D budget authority for general science showed a 9-percent increase in 1983. Overall, NSF programs were expected to increase 7 percent while ERTA programs advanced 13 percent. Support for NSF mathematical and physical sciences was proposed for growth of 6 percent while budget authority for astronomical, atmospheric, earth, and ocean sciences for growth of 8 percent. Biological, behavioral, and social sciences were expected to grow 5 percent, and support for engineering to increase 7 percent. Budget authority for the U.S. Antarctic program was 27 percent higher in 1983, but much of this increase was accounted for by costs for icebreaker operations previously covered by the Coast Guard. Ocean drilling programs were expected to decrease 30 percent in 1983.

Among ERTA programs the largest growth within the general science category was shown in high-energy physics, which advanced 23 percent from 1982 to 1983. Nuclear physics remained at approximately the same level as in 1982 while life sciences research and nuclear medicine applications fell nearly 18 percent.

- **Transportation** R&D activities were expected to grow 11 percent in the 1983 budget. The largest growth, 13 percent, was anticipated for air transportation, the chief component of which is the NASA aeronautical research and technology program. All other R&D activities in this functional area are conducted by subdivisions of the Department of Transportation.

- **Natural resources and environment** showed a 14-percent drop in budget authority from 1982 with the largest declines occurring among EPA pollution control and abatement programs, National Oceanic and Atmospheric Administration programs within Commerce, programs of the Geological Survey and the Bureau of Mines within the Department of the Interior, and those of the Forest Service within the Department of Agriculture (USDA).

- **Agriculture** R&D budget authority increased 7 percent in 1983. All programs are sponsored by USDA, and among the areas receiving increased support were the competitive research grants program, animal and plant production research, programs dealing with use and improvement of soil, water, and air, and human nutrition research.

Basic Research by Function

The 1983 budget provided for some real growth in budget authority for basic research in 1983, with a proposed increase of 9 percent (chart 3). The total was $5.9 billion. Basic research in support of all major functions showed gains ahead of anticipated inflation except for health, which showed a 3-percent increase, and natural resources and environment, which showed a 9-percent decrease.

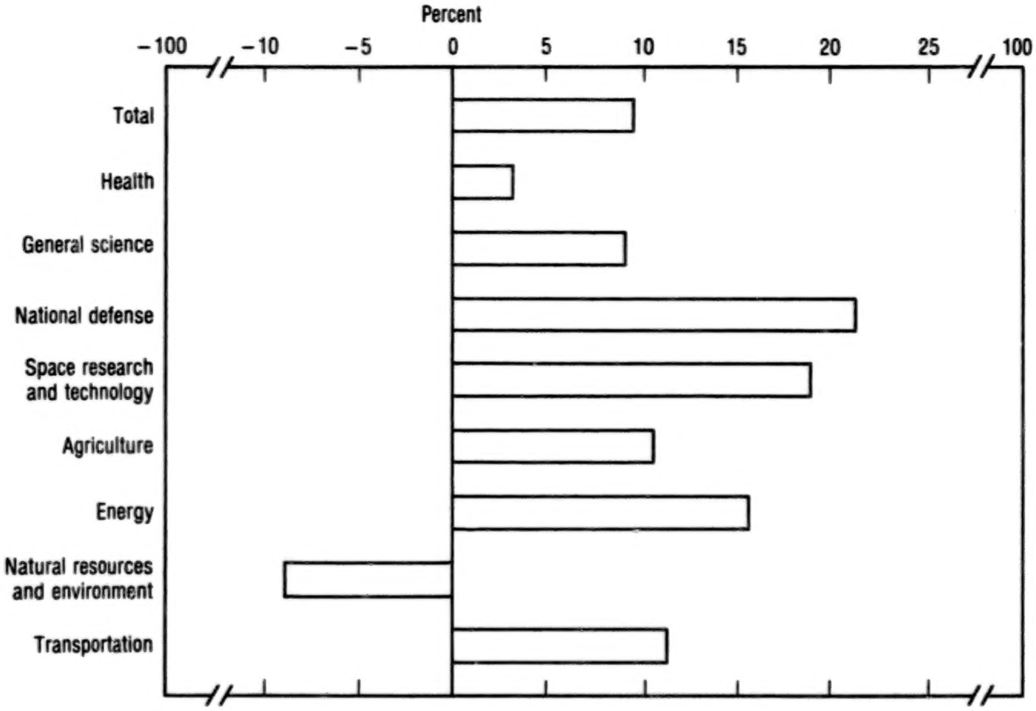
Table 2. Budget authority for basic research by function [Dollars in millions]

Function	1981	1982 estimate	1983 estimate
Total	$5,107	$5,346	$5,855
Health	1,951	1,999	2,066
General science	1,256	1,318	1,439
National defense	610	683	828
Space research and technology	445	482	573
Agriculture	281	292	323
Energy	220	239	276
Natural resources and environment	131	123	112
Transportation	89	99	111
Education, training, employment and social services	66	60	68
Commerce and housing credit	17	19	22
Veterans benefits and services	15	13	14
International affairs	12	9	10
Community and regional development	5	6	6
Administration of justice	5	4	4
General government	3	3	4
Income security	3	([1])	([1])

[1] Less than $500,000.

SOURCE: National Science Foundation

Chart 3. FY 1982-83 percent change in budget authority for basic research, by leading functions in the 1983 Federal budget



SOURCE: National Science Foundation.

More than one-third of all basic research budget authority in 1983 was in support of *health* programs, most of which consist of biomedical research sponsored by NIH (table 2). The *general science* function, which accounted for one-fourth of the Federal basic research total, was scheduled for an increase of 9 percent. NSF basic research programs were expected to increase 7 percent overall, while ERTA basic research was scheduled for nearly a 14-percent gain, almost entirely in high-energy physics. Basic research in support of *national defense* reflected the largest increase of any function—21 percent—all found within the DOD technology base area. *Space research and technology* included a 19-percent increase in basic research budget authority, second only to national defense in relative growth. Most of this activity is in NASA space sciences programs relating to physics and astronomy and planetary exploration. The *agriculture* function showed a proposed increase of 10 percent, mostly for basic research programs of the Agricultural Research Service (USDA). The *energy* function was scheduled for a 16-percent basic research increase in 1983. This provided for growth in the ERTA basic energy sciences program.

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Copies of *Federal R&D Funding by Budget Function: Fiscal Years 1981-83* are obtainable gratis upon request from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550.

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